Syllabus

Course Number: ECE 5440

Title: Computer-Controlled Systems

Credits: 4 (Lecture)

WSU Catalog Description: Prereq: ECE 4470 or CHE 4600 or ME 4400, or consent of instructor

Instructor: Hao Ying, Professor of Electrical and Computer Engineering

Office Hours: 9:30 - 10:30AM, Tuesdays and Thursdays, or by appointment

Office Location: 3144 Engineering Building

Phone: (313) 577-3738

Email: hao.ying@wayne.edu

Course Meeting Time: 10:30 – 12:20PM, Tuesdays and Thursdays, 01/9/2012 - 5/1/2012

Course Meeting Location: 0058 Mano

Goals: To develop the ability to analyze and design discrete-time control systems.

Learning Objectives: At the end of this course, students will be able to:

1. Analyze discrete-time control systems using the z-domain approach and the state space approach
2. Design discrete-time control systems
3. Design quadratic optimal discrete-time control systems


Recommended References:

Prerequisites by Topic: none

Corequisites by Topic: none

Topics:
1. Introduction to Discrete-Time Control Systems.
2. The z Transform.
3. z-Plane Analysis of Discrete-Time Systems.
5. State Space Analysis.
6. Pole Placement and Observer Design.
7. Quadratic Optimal Control.

Course Structure: We will cover major portion of Chapters 1 to 8 of the textbook. There are homework and MATLAB project assignments available under the “Course Documents” area of the WSU Blackboard. Homework and project assignments should be completed independently, and copying will not be acceptable. Deadlines for submitting homework/project assignments will be specified and posted on the Calendar in the Blackboard on each assignment and should be strictly observed. Homework solutions will be available under “Course Documents” in the Blackboard to the student after the homework is turned in.

All exams will be closed-book exams (only a two-page handwriting note will be allowed).

Homework/Project Format: Homework/projects should be written in MS Word or PDF format (a scanned file is acceptable, so is handwriting). For projects, similar items should be included and computer code, if any, should be turned in along with other project material. You may use a software package to zip your files into one file before uploading to the blackboard.

All the homework and project files should be submitted to the instructor via the WSU Blackboard. No email submission will be accepted without exception.

Computer Resources: The course can be best learned using computer simulation on MATLAB Simulink and Control System Toolbox, which are available at the Engineering PC Lab on the second floor of the Engineering Building (Room 2355).

Laboratory Resources: MATLAB and its toolboxes

For your convenience, manuals of MATLAB and some of its Toolboxes are available on the Blackboard.

Grading Weights:
Homework/Projects: 30 %
Midterm Exam: 35 %
Final Exam: 35 %

Grading Scale:
A = 90-100, A- = 88-89, B+ = 85-87, B = 80-84, B- = 78-79, C+ = 75-77, C = 70-74, C- = 68-69, D+ = 65-67, D = 63-64, D- = 60-62, F = 59 or below

Attendance:
A student is expected to attend all lectures. An Attendance Sheet will be required to be signed by every student in every lecture. Active class participation is expected of all students.

It is the student's responsibility to learn the course material. When classes are missed, for whatever reason, it is the obligation of the student to obtain copies of the class materials and the
student is responsible for all materials covered in the lectures. An excused absence does not excuse the student from completing assigned work, including exams.

**Examination Schedule**: The Midterm Exam will be given around March 1 and the Final Exam on April 26, which will be comprehensive.

**Examination Policy**

All students must take the exams on the scheduled dates. No make-up examination will be allowed except for *special and legitimate* circumstances to be considered provided that the instructor is notified as early as possible. The following documentation is required for possibly rescheduling of an examination:

- **Medical Excuse**: A signed letter from a physician from the day of the examination indicating that the student had a valid medical reason for missing school. This letter must be on the physician’s letterhead and the name and phone number of the physician must be legible. (Note: For cases of extended medical treatment, the letter can be dated prior to the examination, if the physician’s recommendation for leave extends beyond the examination date.)
- **Employment Conflict**: A signed letter from the student’s direct supervisor indicating that an absence from the Detroit-area is required for the student’s employment for the dates surrounding the examination.
- **Death in the Family or Family Illness**: A copy of the death certificate or obituary for the family member who has died. For illness of a family member for whom a student is the primary care-giver, a signed letter from the family member’s physician for the day of the examination.
- **Transportation Problem**: In the event that a student is prevented from arriving on campus due to a transportation delay, the following should be provided:
  - A copy of the police report concerning a traffic accident
  - A copy of the receipt for towing from a towing service
  - A signed letter from the Customs and Immigration Officials at the Detroit/Windsor border indicating that a student was delayed for questioning

The final determination of the validity of an excuse is the jurisdiction of the instructor. In all of the above instances, all reasonable attempts must be made to contact the instructor to notify him of the problem before the examination. This can be done via email or via phone. If notice is not provided before the examination, no documentation will be accepted.

**Outcome Coverage**:

(a) **An ability to apply math, science and engineering knowledge.** The learning in this course will require direct application of mathematical, scientific, and engineering knowledge. The learning requires performing computations involving calculus, matrix theory, and z-transform, among other techniques.

(b) **An ability to apply complex variables in the analysis of linear circuits and systems.** This course is based on the z-transform, which is a form of complex analysis. The student will perform the z-transform through the course.
An ability to design and conduct experiments, as well as to analyze and interpret data. The student will carry out computer simulation experiments as well as interpretation of the resulting data using MATLAB and its toolboxes (e.g., Control System Toolbox).

An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. The student will learn to be aware of hardware implementation cost and system performance specification constraints. This outcome is a minor component of the course, though.

Identify, formulate and solve engineering problems. The student will learn how to identify, formulate, and solve automatic control problems.

The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context. The student taking the course will realize the broad applicability of control systems to systems engineering and its impact and benefits to solving real world problems with positive economic and societal consequences.

Accommodations for Students with Disabilities: If you have a documented disability that requires accommodations, you will need to register with Student Disability Services for coordination of your academic accommodations. The Student Disability Services (SDS) office is located at 1600 David Adamany Undergraduate Library in the Student Academic Success Services department. SDS telephone number is 313-577-1851 or 313-577-3365 (TDD only). Once you have your accommodations in place, I will be glad to meet with you privately during my office hours to discuss your special needs. Student Disability Services’ mission is to assist the university in creating an accessible community where students with disabilities have an equal opportunity to fully participate in their educational experience at Wayne State University.

Cheating Policy and Penalty for Cheating: It is the responsibility of each student to adhere to the principles of academic integrity. Academic integrity means that a student is honest with him/herself, fellow students, instructors, and the University in matters concerning his or her educational endeavors. Thus, a student should not falsely claim the work of another as his/her own, or misrepresent him/herself so that the measures of his/her academic performance do not reflect his/her own work or personal knowledge.

Cheating will not be tolerated. Cheating includes (but is not limited to) any communication (written or oral, active or passive) during examinations and sharing of work, such as using the same models or computer programs or copying work. All homework and projects must be an individual effort unless specifically noted. STUDENTS WHO CHEAT ON ANY ASSIGNMENT OR DURING ANY EXAMINATION WILL BE ASSIGNED A FAILING GRADE (i.e., F) FOR THE COURSE. Students who witness cheating should report the incident to the instructor as soon as possible (your identity will be strictly protected).

Note: The WSU policy is that an Incomplete grade can only be assigned if:
1. A student is passing the class based on the other material that has been submitted.
2. The work can be completed without attending the class in a future semester.

Prepared By: Hao Ying, Professor of Electrical and Computer Engineering

Last Revised: Jan. 6, 2012